

CLAIMS

1. A non-thermal plasma reactor, comprising:
a plasma-generating substrate having one or more flow paths for
an exhaust gas, said plasma-generating substrate including first area and second
area, said first area being capable of withstanding a lower compressive force
5 than said second area;
a housing having an inlet opening and an outlet opening;
a voltage source being adapted to supply a voltage to said
plasma-generating substrate for generating a plasma field; and
a retention material retaining said plasma-generating substrate in
10 said housing such that said one or more flow paths are in fluid communication
with said inlet opening and said outlet opening, said retention material being
configured to provide a higher retention force to said first area and a lower
retention force to said second area.
2. The non-thermal plasma reactor of claim 1, further
comprising a coating material on an inside of said housing and an outside of
said plasma-generating substrate.
3. The non-thermal plasma reactor of claim 2, wherein said
coating material is selected from the group consisting of high friction coatings,
electrical insulating coatings and high friction, electrical insulating coatings.
4. The non-thermal plasma reactor of claim 1, wherein said
retention material includes more than one layer having varying densities to
provide said higher retention force to said first area and said lower retention
force to said second area.

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5. The non-thermal plasma reactor of claim 4, wherein said retention material includes a first layer of retention material and a second layer of retention material, said first layer having a higher density than said second layer, said second layer being provided at said second area of said substrate, and said first layer being provided at said first area of said substrate and over said second layer.

6. The non-thermal plasma reactor of claim 4, wherein said housing has more than one gap space between said housing and said substrate to provide said higher retention force to said second area and said lower retention force to said first area.

7. The non-thermal plasma reactor of claim 1, wherein said housing has more than one gap space between said housing and said substrate to provide said higher retention force to said second area and said lower retention force to said first area.

8. The non-thermal plasma reactor of claim 7, wherein said housing includes a first gap and a second gap, said first gap being larger than said second gap, said first gap being provided at said first area such that said retention material provides said lower retention force to said first area, and said second gap being provided at said second area such that said retention material provides said higher retention force to said second area.

9. A unitary exhaust system component, comprising:

a non-thermal plasma reactor for oxidizing nitrogen oxides in an exhaust stream to nitrogen dioxide, said non-thermal plasma reactor including an inlet opening and an outlet opening, a plasma-generating substrate having one or more exhaust passages in fluid communication with said inlet opening and said outlet opening, and a voltage supplied to said plasma-generating substrate for generating a plasma field;

a particulate filter for capturing particulate matter from said exhaust stream, said particulate filter being in fluid communication with said inlet opening or said outlet opening;

a catalytic converter for removing nitrogen dioxide, hydrocarbons and carbon monoxides from said exhaust stream, said catalytic converter being downstream of said non-thermal plasma reactor and said particulate filter; and

a single housing containing said non-thermal plasma reactor, said particulate filter and said catalytic converter.

10. The unitary exhaust system component of claim 9, further comprising a coating material on an inside of said single housing and an outside of said plasma-generating substrate.

11. The unitary exhaust system component of claim 10, wherein said coating material is selected from the group consisting of high friction coatings, electrical insulating coatings and high friction, electrical insulating coatings.

12. The unitary exhaust system component of claim 9, further comprising a retention material retaining said plasma-generating substrate in said single housing, said retention material providing a higher retention force to at least one strong area of said plasma-generating substrate and a lower retention force to at least one weak area of said plasma-generating substrate.

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13. The unitary exhaust system component of claim 12, further comprising more than one layer of said retention material provided at said at least one strong area creating said higher retention force in said at least one strong area, and one later of said retention material provided at said at least one weak area creating said lower retention force in said at least one weak area.

14. The unitary exhaust system component of claim 13, wherein said more than one layer of said retention material provided at said at least one strong area comprises a first layer of retention material and a second layer of retention material.

15. The unitary exhaust system component of claim 13, wherein said single housing has more than one gap space between said single housing and said substrate to provide said higher retention force to said at least one strong area and said lower retention force to said at least one weak area.

16. The unitary exhaust system component of claim 12, wherein said single housing has more than one gap space between said single housing and said substrate to provide said higher retention force to said at least one strong area and said lower retention force to said at least one weak area.

17. The exhaust system of claim 16, wherein said single housing includes a first gap and a second gap, said first gap being larger than said second gap, said first gap being provided at said at least one weak area such that said retention material provides said lower retention force to said at least one weak area, and said second gap being provided at said at least one strong area such that said retention material provides said higher retention force to said at least one strong area.

18. A method of retaining a non-thermal plasma-generating substrate, comprising:

providing a housing having a first open end and a second open end;

providing a non-thermal plasma-generating substrate having one or more flow paths for an exhaust gas, said non-thermal plasma-generating substrate including at least one weak area and at least one strong area;

wrapping said non-thermal plasma-generating substrate with a retention material; and

stuffing said non-thermal plasma-generating substrate wrapped with said retention material in said housing through said first open end or said second open end to retain said plasma-generating substrate in said housing such that said one or more flow paths are in fluid communication with said first open end and said second open end, and said retention material provides a higher retention force to said at least one strong area and a lower retention force to said at least one weak area.

19. The method of claim 18, further comprising securing an first end cap to said first open end to define an inlet opening, and securing a second end cap to said second open end to define an outlet opening.

20. The method of claim 18, further comprising coating an inside of said housing and an outside of said non-thermal plasma-generating substrate with a material selected from the group consisting of high friction coatings, electrical insulating coatings and high friction, electrical insulating coatings.

21. The method of claim 18, wherein said wrapping step comprises wrapping said at least one strong area with a first layer of retention material, wrapping said at least one weak area and said first layer with a second layer of retention material, said first layer having a higher density than said second layer.

22. The method of claim 18, wherein said housing includes a first gap and a second gap, said first gap being larger than said second gap, said first gap being provided at said at least one weak area such that said retention material provides said lower retention force to said at least one weak area, and
5 said second gap being provided at said at least one strong area such that said retention material provides said higher retention force to said at least one strong area.

23. A method of retaining a non-thermal plasma-generating substrate, comprising:
providing a first half shell and a second half shell defining a housing;
5 providing a non-thermal plasma-generating substrate having one or more flow paths for an exhaust gas, said plasma-generating substrate including at least one weak area and at least one strong area;
wrapping said non-thermal plasma-generating substrate with a retention material; and
10 securing said first half shell to said second half shell to retain said non-thermal plasma-generating substrate in said housing such that said retention material provides a higher retention force to said at least one strong area and a lower retention force to said at least one weak area.

24. The method of claim 23, further comprising coating an inside of said first half shell and said second half shell and an outside of said non-thermal plasma-generating substrate with a material selected from the group consisting of high friction coatings, electrical insulating coatings and high
5 friction, electrical insulating coatings.

25. The method of claim 23, wherein said wrapping step comprises wrapping said at least one strong area with a first layer of retention material, wrapping said at least one weak area and said first layer with a second layer of retention material, said first layer having a higher density than said
5 second layer.

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26. The method of claim 23, wherein said housing includes a first gap and a second gap, said first gap being larger than said second gap, said first gap being provided at said at least one weak area such that said retention material provides said lower retention force to said at least one weak area, and said second gap being provided at said at least one strong area such that said retention material provides said higher retention force to said at least one strong area.

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